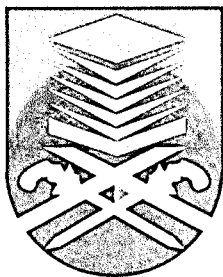


**DESIGN OF DIRECT FEED PATCH ANTENNA USING MULTILAYER
LTCC TECHNOLOGY**

**This is presented in partially fulfillment for the award of the
Bachelor of Engineering (Hons.) Electronics (Communication)
UNIVERSITI TEKNOLOGI MARA (UTM)**



**FAKHRUDDIN BIN MOHAMAD SAUPE
FACULTY OF ELECTRICAL ENGINEERING
UNIVERSITI TEKNOLOGI MARA
40450 SHAH ALAM SELANGOR
MALAYSIA**

JULY 2013

ACKNOWLEDGEMENT

Alhamdulillah, to Him we praise and ask forgiveness. And thanks to Allah the Almighty and the Most Merciful, that gives me strength and provides me adequacy of physical and mental health that enables me to complete this thesis.

After that, I would like to express my sincere gratitude and indebtedness to my supervisor, Mrs Suhaila Subahir for her valuable guidance, encouragement and affection for the successful completion of this thesis.

Finally, I would like to thank all my friends and well-wishers who were involved directly or indirectly during completion of this thesis. Also, not forgetting, a big thanks to my parents, my brothers and sisters who provides me support and financial help for completing this thesis.

Thank you.

ABSTRACT

This paper presents the design of direct feed LTCC antenna with two feeding types operating at 1.575GHz frequency band with voltage standing wave ratio (VSWR) less than two. The feeding types chosen for this LTCC antenna design are inset feed and quarter-wave feed. These two types of direct coupled feed have been designed on the rectangular and circular LTCC antenna with Ferro A6S LTCC substrates with dielectric constant, ϵ_r of 5.9 and thickness, h of 0.096mm. The analysis has been made between the same patch shape with the different feeding types and vice versa. The design and simulation process for both rectangular and circular LTCC antenna have been made using CST Microwave Studio. The detail analysis of the antenna designed and simulated results of return loss, gain, bandwidth, voltage standing wave ratio (VSWR) and radiation pattern were presented and discussed. The results showed that the rectangular LTCC patch antenna with inset feed exhibit good performance characteristic compared to the circular LTCC patch antenna with inset feed for analysis of different patch shape. Furthermore, for feeding type analysis, the rectangular LTCC patch antenna with inset feed exhibit good performance characteristic compared to the rectangular LTCC antenna with quarter wave feed.

TABLE OF CONTENTS

DECLARATION.....	i
ACKNOWLEDGEMENT.....	iii
ABSTRACT.....	iv
LIST OF FIGURES.....	vii
LIST OF TABLES.....	ix
LIST OF SYMBOLS AND ABBREVIATIONS.....	x
CHAPTER 1.....	1
INTRODUCTION.....	1
1.1 Background of the Study.....	1
1.2 Problem Statement.....	2
1.3 Objective.....	4
1.4 Scope of Work.....	4
1.5 Thesis Organization.....	4
CHAPTER 2.....	6
LITERATURE REVIEW.....	6
2.1 Low Temperature Co-fired Ceramic (LTCC) Technology.....	6
2.1.1 Typical Materials for LTCC technology.....	6
2.1.2 Manufacturing Process.....	7
2.1.3 Advantages of LTCC technology.....	8
2.2 Antenna Theory.....	9
2.3 Microstrip Antenna.....	12
2.4 Antenna Parameters.....	13
2.4.1 Return Loss.....	13
2.4.2 Voltage Standing Wave Ratio.....	14
2.4.3 Bandwidth.....	14
2.4.4 Gain.....	15
2.4.5 Radiation Pattern.....	15
2.5 Antenna Feeding Techniques.....	18
2.5.1 Microstrip Line Feed.....	18
2.5.2 Coaxial Feed.....	18
2.5.3 Aperture Coupled Feed.....	19
2.5.4 Proximity Coupled Feed.....	20
2.5 Previous reviewed.....	20

CHAPTER 3	30
METHODOLOGY	30
3.1 Flow Chart	30
3.2 Antenna Design Specifications	31
3.3 Rectangular Patch Antenna Design.....	32
3.4 Circular Patch Antenna Design.....	33
3.5 Inset Feed Design.....	34
3.6 Quarter Wave Matched Feed Design	35
3.7 Geometry of Inset Feed Rectangular LTCC Patch Antenna.....	36
3.8 Geometry of Inset Feed Circular LTCC Patch Antenna	37
3.9 Geometry of Quarter Wave Feed Rectangular LTCC Patch Antenna	38
3.10 Geometry of Quarter Wave Feed Circular LTCC Patch Antenna	39
CHAPTER 4	40
RESULTS AND DISCUSSION	40
4.1 Simulation Results of Rectangular LTCC Patch Antenna with Inset Feed.....	40
4.2 Simulation Results of Circular LTCC Patch Antenna with Inset Feed.....	42
4.3 Simulation Results of Rectangular LTCC Patch Antenna with Quarter Wave Feed	44
4.4 Simulation Results of Circular LTCC Patch Antenna with Quarter Wave Feed	46
4.5 Overall comparison of rectangular and circular LTCC patch antenna with inset feed and quarter wave feed.....	48
CHAPTER 5	50
CONCLUSION.....	50
CHAPTER 6	51
FUTURE RECOMMENDATION.....	51
REFERENCES	52
APPENDICES	55
Rectangular LTCC Patch Antenna With Inset Feed	56
Circular LTCC Patch Antenna With Inset Feed	58
Rectangular LTCC Patch Antenna With Quarter Wave Feed	60
Circular LTCC Patch Antenna With Quarter Wave Feed.....	62
Technical Paper.....	64